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ABSTRACT

The purpose of this study was to identify and analyze interaction effects of selected psychosocial variables on the development of subsequent smoking behavior among youth who had originally identified themselves on a survey as never having smoked. The subjects were seventh grade students who had participated in a total of three surveys over a two year period. At the end of the two year study period, the subjects identified themselves according to their present smoking behavior as either a smoker, ex-smoker, or never smoked. The psychosocial independent variables analyzed were (1) future educational plans, (2) organized school athletic team participation, (3) time spent per week in extracurricular school group activities, (4) parental smoking behavior, (5) peer smoking behavior, (6) whether or not any relatives or friends had died of lung cancer, (7) knowledge of the Surgeon General's Report on Smoking, (8) students' own perceived future smoking behavior, and (9) parental attitude toward smoking as perceived by students. The data were analyzed by sex. Findings suggested that the interaction effects of several psychosocial variables are indicative of subsequent smoking behavior among youth. (Author/RC)

A MULTIVARIATE ANALYSIS OF SELECTED PSYCHOSOCIAL VARIABLES ON THE DEVELOPMENT OF SUBSEQUENT YOUTH SMOKING BEHAVIOR[1,2]

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INTRODUCTION

A plethora of previous research studies[1-18] have indicated that there are a number of psychosocial variables associated with youth cigarette smoking behavior. Horn et al.[1], Salber, Welsh, and Taylor[3], Lawton[19], Streit[20], Levitt[21], and Williams[22] have all reported that there is no single reason why youths take up the smoking habit. Cattell and Krug[23], Wohlford and Giammona[10], Davis[24], Woody[15], and O'Rourke[25] have pointed out that cigarette smoking is a complex, multiply determined behavior. Fodor, Glass and Weiner, taking into consideration the complexity of smoking behavior, stated that:

> . . . educational programs that are developed will, of necessity, have to deal with the totality of man as a complex being. "Smoking education," in fact, must become health education, taking into consideration the multiplicity of factors related to smoking and health (physical, mental, and social).[8]

If the health educator is to be an agent of behavioral and social change, his intervention in youth smoking behavior will have to be based upon a better understanding of complex psychosocial variables that may be influential behavioral determinants of youth propensity toward cigarette smoking behavior.

While most of the previous investigations of smoking behavior among youth have addressed the problem from a univariate methodological and statistical approach, there has been a relative paucity of studies[11,17] that have utilized multivariate methods in studying psychosocial variables related to youth smoking behavior. Considering the complexity of human behavior in general and the multitude of factors that may be implicated in

youth smoking behavior in particular, it is reasonable to suspect that psychosocial variables do not act independently of each other but, rather, that their interaction effects may predispose or perpetuate subsequent youth smoking behavior. If and to what extent interaction effects of psychosocial variables influence the development of subsequent youth smoking behavior, is a problem that demands experimental research.

In 1966, the University of Illinois contracted with the National Clearinghouse for Smoking and Health to conduct a longitudinal study of trends in youth smoking behavior. This particular study was an aspect of the University of Illinois Anti-Smoking Education Study and was conducted over a period of two years in order to investigate the interaction effects of selected psychosocial variables on the development of subsequent youth smoking behavior.

PURPOSE

The major purpose of this study was to analyze interaction effects of selected psychosocial variables on the development of subsequent smoking behavior among a cohort of youth who had originally identified themselves on a survey as having never smoked. More specifically, this study endeavored to determine if interaction effects of selected psychosocial variables could be utilized as indicators of subsequent smoking behavior among original youth never smokers.

SIGNIFICANCE

Educational Significance

By attempting to analyze significant interaction effects of selected psychosocial variables on the development of subsequent smoking behavior

among youth; this study would appear to enhance anti-smoking education programs. Results of this study might be utilized in the development of content and methodology designed for effective preventive health education approaches to the school-aged youth who is predisposed toward smoking behavior.

Methodological Significance

In order to investigate the possible influence of interaction effects of selected psychosocial variables on the development of subsequent youth smoking behavior, a research design utilizing a multivariate method appears appropriate. Levitt and Edwards[11] pointed out that research methodology used in previous studies of cigarette smoking behavior among youth, have been inadequate for the task of investigating the interaction effects of psychosocial variables that may serve to influence the development of subsequent youth smoking behavior. They noted that:

> Most of the investigations of cigarette smoking among school-aged children have been multifactor, but most of the analyses in those studies have been single factor, or at best, cross-tabulations of two variables plus a nonparametric statistical analysis. This type of data treatment is relatively inefficient and can easily lead to improper inferences.[11]

The multivariate techniques used in this study provide for a more realistic appraisal of the complex causal processes of youth smoking behavior. The analysis of interaction effects of psychosocial variables that are indicative of subsequent smoking behavior among youth, should provide further insight into future experimental research directed at understanding and predicting youth smoking behavior.

METHODS AND PROCEDURES

Selection of Subjects

The University of Illinois Survey instrument was administered to an original total of 23,724 Rockford-Winnebago County youths in grades seven through twelve. However, only data obtained from seventh grade students who originally identified themselves as never smokers in the initial survey of 1966 were utilized in this particular study in order to observe changes in smoking behavior. A total of 4,486 seventh grade students were administered the initial survey, of which 2,261 were males and 2,225 were females. Of the total 4,486 seventh grade students who were administered the initial survey in 1966, 3,171 (1,536 male and 1,635 female) subjects were matched and identified as having participated in the initial survey of 1966, a second survey in 1967 and a third survey in 1968. The study population was comprised of 2,090 (864 male and 1,226 female) matched seventh grade students who identified themselves as never smokers.

Survey Instrument Employed

The survey instrument used in this study was developed specifically for the University of Illinois Anti-Smoking Education Study. The purpose of the survey instrument was to collect demographic data on the student, information about his or her smoking behavior, and attitudes-beliefs associated with smoking behavior. The survey instrument consisted of four parts and a total of 88 items, of which 44 were descriptive information items and 44 were attitude-belief items.

The response given to item 21 of Part I of the University of Illinois

Survey instrument provided a smoking behavior classification for students participating in the survey. According to the way he or she responded, a student was classified as either a never smoker, an ex-smoker, or a smoker. Item 21 was of particular significance to the methodology of this study because it was necessary to first identify those students out of the total population of 3,171 seventh grade students who were never smokers in 1966. On the basis of how they responded to item 21 of the survey instrument in 1968, it could then be ascertained whether previously matched and identified never smokers in 1966 either remained never smokers, or had changed their smoking behavior over a subsequent period of two years following the initial survey.

Experimental Procedure

The University of Illinois Survey instrument was administered to students three times during a two-year period (1966-1968). The longitudinal design of the University of Illinois Anti-Smoking Education Study necessitated that an identification number be assigned to each participant after the administration of the initial survey. Answer sheets with the name and identification numbers of each student who had participated in the initial survey were prepared in advance of the second and third administration of the survey instrument. This procedure was undertaken so as to be able to identify all three answer sheets as belonging to a particular student.

Statistical Procedure

Independent Variables. The psychosocial independent variables selected for study were:

(1) future educational plans;
(2) organized school athletic team participation;
(3) time spent per week in extracurricular school group activities;
(4) parental smoking behavior;
(5) peer smoking behavior;
(6) whether or not any relatives or friends had died of lung cancer;
(7) knowledge of the Surgeon General's Report on Smoking;
(8) students' own perceived future smoking behavior; and
(9) parental attitude toward smoking as perceived by students.

Each independent variable corresponded to an item on the survey instrument. However, in order to generate a sufficient number of subject replications within each cell of a factorial design matrix larger than 2x3 (6 cells), it was necessary to collapse and recode the number of possible responses from which a student could choose in some items.*

Dependent Variable. The dependent variable in this study was actual smoking behavior as indicated by each subject's response to item 21 of the survey instrument in 1968. One of the assumptions underlying this study was that smoking behavior occurred on a continuum ranging from a never smoker, to an ex-smoker, to a smoker.

Method of Analysis. Factorial design matrices were developed from the data. Each matrix was formed by experimentally juxtaposing two independent variables. How a subject in the study responded to each of two items on the initial survey in 1966, determined the cell in which he or she was replicated.

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*For a complete description of how items from the survey instrument were collapsed and recoded, see: J.P. Allegrante, "A Multivariate Analysis of Selected Psychosocial Variables on the Development of Subsequent Youth Smoking Behavior" (unpublished Master's thesis, University of Illinois, Urbana, 1975), Appendix C.

The number of subject replications and mean smoking behavior value were obtained for each cell, column, and row of the matrix. These data were subjected to a multifactor analysis of variance to determine statistically significant main and interaction effects. The level of significance for this study was set at .05.

F-ratios indicating the statistical significance of the two main effects and the interaction effect were obtained from the analysis. By analyzing the variability among group mean smoking behavior values, it was possible to determine if interaction effects of selected psychosocial variables (as indicated in 1966) were indicative of subsequent smoking behavior in 1968 among the study population of original seventh grade never smokers.

RESULTS AND DISCUSSION

The results of the experimental testing for interaction effects of the psychosocial independent variables selected for study are summarized in Table 1.

(Insert Table 1 here)

Table 1 shows which independent variables were juxtaposed in each experiment and indicates that statistically significant interaction effects were found among three of the seven total factorial experiments that were conducted. For the purposes of this paper, only the results from those experiments in which interaction effects were observed will be reported in detail.

Parental Attitude and Behavior

It was hypothesized that the interaction effect of parental attitude toward smoking as perceived by youth and parental smoking behavior would

be indicative of subsequent smoking behavior among original youth never smokers. Specifically, those never smokers who perceived their parents' attitude toward smoking as being that of approval and reported that their parents smoked cigarettes, would exhibit significantly greater smoking behavior at the end of the two-year study period than those subjects who perceived their parents' attitude toward smoking as being that of disapproval and whose parents did not smoke. As shown in Table 1, separate factorial experiments were conducted to analyze the interaction effect of the attitude and behavior of both the father and mother on the development of subsequent smoking behavior among male and female youth never smokers.

Father's Attitude and Behavior. The multifactor analysis of variance of the data revealed no significant interaction effect of the father's smoking attitude and behavior on the development of subsequent smoking behavior among either male or female never smokers. However, the father's attitude toward smoking as perceived by male never smokers had a significant main effect on their subsequent smoking behavior. Regardless of whether or not the father smoked cigarettes, the smoking behavior of those seventh grade male never smokers who perceived their fathers' attitude toward smoking as being that of approval, was significantly greater than that of those who perceived their fathers' attitude toward smoking as being that of disapproval. Contrary to what much of the literature indicated, the behavior of the father was not significantly related to the development of subsequent smoking behavior. Although the attitude of the parent in this case appeared to be a significant factor associated with the development of subsequent smoking behavior, this

result must be interpreted cautiously. Further examination of the data indicated that only a small percentage (3%) of the subjects reported that they perceived their fathers' attitude toward smoking as being that of approval.

These findings suggest that in attempting to prevent the initiation of smoking among young males, modification of the father's prevailing attitude toward smoking is not the way to attack the problem. Essentially, it would be inefficient for schools and public health authorities to direct any large-scale program of attitude change at a parent, when only a small percentage of the youth population (whose behavior we are trying to affect) might benefit.

Mother's Attitude and Behavior. The presence of a significant interaction effect of the mother's smoking attitude and behavior on the development of subsequent smoking behavior was observed among male subjects only. Table 2 presents the summary of the multifactor analysis of variance of the data.

(Insert Table 2 here)

Analysis of the data revealed that the greatest smoking behavior at the end of the two-year study period occurred when seventh grade male never smokers perceived their mothers' attitude toward smoking as being that of approval and reported that she smoked cigarettes. The smoking behavior of these subjects was significantly greater than that of those subjects who perceived their mothers' attitude toward smoking as being that of approval but reported that their mothers did not smoke. These findings partially supported the directional hypothesis. As was noted

earlier, it was hypothesized that those subjects who perceived their parents' attitude toward smoking as being that of disapproval and whose parents did not smoke would exhibit the least smoking behavior at the end of the two-year study period. In the interaction of these two variables, it was the mother's behavior that appeared to be the controlling variable in the development of subsequent smoking behavior among seventh grade male never smokers. It is, however, difficult to infer significance from these results because of the composition of the data. Once again these results are questionable because less than one percent of the male subjects perceived their mothers' attitude toward smoking as being that of approval.

In essence, the homogenity of subject response, with respect to the perception of parental attitude toward smoking, renders it impossible to determine experimentally the extent to which the interaction effect of parental attitude and behavior influences the development of subsequent smoking behavior among youth never smokers. In terms of preventing youth from initiating the smoking habit, the implications are apparent. Specifically, the data suggest that anti-smoking education programs should focus attention on the prevention or discontinuation of parental smoking behavior rather than attitudinal change, for the latter appears to be already conducive to youth nonsmoking behavior.

Indirect Experience with Lung Cancer and Perceived Future Smoking Behavior

As shown by Tables 3 and 4, a significant interaction effect of whether or not any relatives or friends of the subjects had died of lung cancer (indirect experience) and the subjects' own perceived future

smoking behavior was found to be indicative of subsequent smoking behavior among both male and female subjects.

(Insert Tables 3 and 4 here)

The nature of the expectation of this particular interaction was that those subjects who had not had any relatives or friends die of lung cancer and who had perceived themselves as future smokers, would exhibit significantly greater smoking behavior at the end of the two-year study period than those subjects who had had relatives or friends die of lung cancer and had not perceived themselves as future smokers.

As hypothesized, the greatest smoking behavior in male subjects occurred when the subjects had not had any relatives or friends die of lung cancer and had perceived themselves as future smokers. However, the least smoking behavior was observed among those male never smokers who had not had any relatives or friends die of lung cancer but had not perceived themselves as future smokers.

In females, any component of fear of dying from lung cancer that may have acted as a deterrent to them taking up cigarette smoking did not seem to affect their decision to smoke. The greatest smoking behavior was found among those female subjects who had had relatives or friends die of lung cancer and who had perceived themselves as future smokers. The significantly lowest smoking behavior that was recorded was a function of subjects not having had relatives or friends die of lung cancer together with not having had perceived themselves as future smokers.

The results from this particular experiment suggest that for both male and female youth never smokers, those who have not had indirect experience with lung cancer and who do not perceive themselves as future smokers are not likely to be the prime candidates for assignment to anti-smoking

education. Instead, preventive health education programs should concentrate on directing efforts toward youth never smokers who perceive themselves as being future smokers, notwithstanding whether or not they have had indirect experience with lung cancer.

Knowledge of Surgeon General's Report and Perceived Future Smoking Behavior

The third significant interaction effect of two psychosocial variables, which was indicative of subsequent smoking behavior among only female never smokers, was that which resulted from the subjects' reported knowledge of the Surgeon General's Report on Smoking and their own perceived future smoking behavior. Table 5 summarizes the multi-factor analysis of variance of the data.

(Insert Table 5 here)

Analysis of the data indicated that at the end of the two-year study period, those female never smokers who reported that they had "known alot" about the Surgeon General's Report and who had perceived themselves as future smokers, had significantly greater smoking behavior than those who reported they "did not know" about the Surgeon General's Report and who had not perceived themselves as future smokers. These findings differed from what was intuitively expected. Presumably, those never smokers who reported that they had "known alot" about the report and had not perceived themselves as future smokers, would have exhibited the least smoking behavior. This was based on the assumption that some knowledge of the possible harmful effects of cigarette smoking (as documented by the Surgeon General's Report) would further prevent youth who had already failed to perceive themselves as future smokers from

smoking. Correspondingly, the greatest subsequent smoking behavior was expected to be associated with those never smokers who reported knowing nothing about the Surgeon General's Report and who had perceived themselves as future smokers. With respect to the knowledge component, the exact opposite was observed.

These results suggest that youth who may be predisposed toward smoking may also be inclined to seek information about the effects of smoking. However, those youths who are more orientated toward a non-smoking behavior may feel no need to know about the Surgeon General's Report or the effects of cigarette smoking. Simply, such knowledge has no personal relevance for them. Youth who appear to be "knowledgeable" about the Surgeon General's Report and who perceive themselves as future smokers, might be selected for intensive anti-smoking education.

SUMMARY

The purpose of this study was to determine if interaction effects of selected psychosocial variables could be utilized as indicators of subsequent smoking behavior among youth who had originally identified themselves on a survey as having never smoked. Interaction effects of several psychosocial variables selected for study were found to be indicative of subsequent smoking behavior. These findings illustrate that youth smoking is a complex behavior which is influenced, in part, by interacting concomitant psychosocial factors. Such interactions might serve as indicators in predicting future smoking behavior. In future experimental research aimed at understanding and predicting youth

smoking behavior, consideration should be given to identifying and analyzing multiple combinations of psychosocial factors by utilizing multivariate as opposed to univariate research methods.

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TABLE 1

SUMMARY OF EXPERIMENTAL RESULTS

Experiment	Interaction Effect	Main Effects
Father's Smoking Behavior (A) and Father's Attitude Toward Smoking as Perceived by Students (B)	None	(A) None (B) Males[1]
Mother's Smoking Behavior (A) and Mother's Attitude Toward Smoking as Perceived by Students (B)	Males[1]	(A) Males[2] (B) None
Organized School Athletic Team Participation (A) and Time Spent Per Week in Extracurricular School Group Activities (B)	None	(A) None (B) None
Peer Smoking Behavior (A) and Students' Own Perceived Future Smoking Behavior (B)	None	(A) None (B) Males[2], Females[2]

[1]Significant at the .05 level.

[2]Significant at the .01 level.

TABLE 1 (continued)

Experiment	Interaction Effect	Main Effects
Whether or Not Any Relatives or Friends Had Died of Lung Cancer (A) and Students' Own Perceived Future Smoking Behavior (B)	Males[1], Females[1]	(A) Females[1] (B) Males[2], Females[2]
Knowledge of the Surgeon General's Report on Smoking (A) and Students' Own Perceived Future Smoking Behavior (B)	Females[1]	(A) Males[1], Females[1] (B) Males[2], Females[2]
Future Educational Plans (A) and Students' Own Perceived Future Smoking Behavior (B)	None	(A) Males[2] (B) Females[2]

[1]Significant at the .05 level.

[2]Significant at the .01 level.

TABLE 2

SUMMARY OF MULTIFACTOR ANALYSIS OF VARIANCE, MOTHER'S SMOKING BEHAVIOR (VARIABLE A) AND MOTHER'S ATTITUDE TOWARD SMOKING AS PERCEIVED BY STUDENTS (VARIABLE B)

(MALES)

Source of Variation	Degrees of Freedom Num.	Den.	SS	MS	F	Probability
VARIABLE A	1	708	3.02	3.02	7.20	.01
VARIABLE B	1	708	.94	.94	2.24	.13
VARIABLE AXB	1	708	2.38	2.38	5.66	.02
WITHIN CELLS (ERROR)	708	708	297.28	.42		

TABLE 3

SUMMARY OF MULTIFACTOR ANALYSIS OF VARIANCE, WHETHER OR NOT ANY RELATIVES OR FRIENDS HAD DIED OF LUNG CANCER (VARIABLE A) AND STUDENTS' OWN PERCEIVED FUTURE SMOKING BEHAVIOR (VARIABLE B)

(MALES)

Source of Variation	Degrees of Freedom Num.	Den.	SS	MS	F	Probability
VARIABLE A	1	523	.20	.20	.54	.46
VARIABLE B	1	523	7.99	7.99	21.96	.00
VARIABLE AXB	1	523	1.40	1.40	3.85	.05
WITHIN CELLS (ERROR)	523		190.29	.36		

TABLE 4

SUMMARY OF MULTIFACTOR ANALYSIS OF VARIANCE, WHETHER OR NOT ANY RELATIVES OR FRIENDS HAD DIED OF LUNG CANCER (VARIABLE A) AND STUDENTS' OWN PERCEIVED FUTURE SMOKING BEHAVIOR (VARIABLE B)

(FEMALES)

Source of Variation	Degrees of Freedom Num.	Den.	SS	MS	F	Probability
VARIABLE A	1	665	2.14	2.14	4.48	.03
VARIABLE B	1	665	13.51	13.51	28.27	.00
VARIABLE AXB	1	665	1.89	1.89	3.96	.05
WITHIN CELLS (ERROR)	665		317.69	.48		

TABLE 5

SUMMARY OF MULTIFACTOR ANALYSIS OF VARIANCE, KNOWLEDGE OF THE SURGEON GENERAL'S REPORT ON SMOKING (VARIABLE A) AND STUDENTS' OWN PERCEIVED FUTURE SMOKING BEHAVIOR (VARIABLE B)

(FEMALES)

Source of Variation	Degrees of Freedom Num.	Den.	SS	MS	F	Probability
VARIABLE A	2	1,181	3.77	1.88	4.14	.02
VARIABLE B	1	1,181	9.01	9.01	19.79	.00
VARIABLE AXB	2	1,181	3,40	1.70	3.73	.02
WITHIN CELLS (ERROR)	1,181		537.79	.46		